

WHAT IS CLAIMED IS:

1. An apparatus for exposing a latent watermark along a length of photosensitive medium, the apparatus comprising:
 - (a) an illumination source for providing an exposure illumination;
 - (b) a first spatial light modulator for modulating said exposure illumination to form a first exposure pattern according to first image data;
 - (c) a second spatial light modulator for modulating said exposure illumination to form a second exposure pattern according to second image data;
 - (d) combining optics providing a single output path for directing said first and second exposure patterns onto the photosensitive medium;
 - (e) a transport for providing, during exposure, lengthwise displacement of the photosensitive medium with respect to said single output path; wherein said first and second spatial light modulators cyclically alternate in providing respective first and second exposure patterns to said combining optics, such that during a cycle wherein said first spatial light modulator forms said first exposure pattern, said second spatial light modulator loads the image data for providing said second exposure pattern; and said first and second exposure patterns thereby forming, lengthwise along the photosensitive medium, said latent image comprising modulated stripes having a predetermined intensity corresponding to said first and second exposure patterns.
2. An apparatus for exposing a latent watermark according to claim 1 wherein said illumination source is selected from a group comprising a lamp, an LED, and a laser.
3. An apparatus for exposing a latent watermark according to claim 1 wherein said illumination source comprises:

(a) a first light source for providing illumination to said first spatial light modulator; and

(b) a second light source for providing illumination to said second spatial light modulator.

4. An apparatus for exposing a latent watermark according to claim 1 wherein said illumination source comprises:

(a) a first LED for providing illumination to said first spatial light modulator; and

(b) a second LED for providing illumination to said second spatial light modulator.

5. An apparatus for exposing a latent watermark according to claim 1 wherein said first spatial light modulator is selected from a group comprising a reflective LCD, a transmissive LCD, and a DMD.

6. An apparatus for exposing a latent watermark according to claim 1 wherein said combining optics comprises a polarization combiner.

7. An apparatus for exposing a latent watermark according to claim 1 wherein said combining optics comprises a polarization beamsplitter.

8. An apparatus for exposing a latent watermark according to claim 1 wherein said photosensitive medium is a motion picture print film.

9. An apparatus for exposing a latent watermark according to claim 1 wherein said first exposure pattern is modulated during said cycle.

10. An apparatus for exposing a latent watermark according to claim 1 further comprising a heater for heating said spatial light modulator.

11. An apparatus for exposing a latent watermark according to claim 1 wherein said first exposure pattern is formed only on a fractional segment of the image forming surface of said first spatial light modulator.

12. An apparatus for exposing a latent watermark according to claim 11 wherein said first spatial light modulator is disposed with said fractional segment centered on the optical output path.

13. An apparatus for exposing a latent watermark according to claim 1 wherein said exposure illumination is monochrome.

14. An apparatus for exposing a latent watermark according to claim 12 wherein said exposure illumination is blue.

15. An apparatus for exposing a latent watermark according to claim 1 wherein said illumination source comprises an LED and a drive circuit that provides pulses exceeding the continuous current rating of said LED.

16. An apparatus for exposing a latent watermark according to claim 1 wherein said first exposure pattern and said second exposure pattern are spatially interleaved.

17. An apparatus for exposing a latent watermark according to claim 1 wherein said first exposure pattern is arranged on a surface of said first spatial light modulator as a rectangular set of pixels with a length direction of said rectangular set of pixels corresponding to a direction of displacement of the photosensitive medium.

18. An apparatus for exposing a latent watermark as a series of lengthwise stripes along a length of photosensitive medium comprising:

(a) an illumination source for providing an exposure illumination;

(b) a first spatial light modulator for modulating said exposure illumination to form a first exposure pattern according to image data;
(c) a second spatial light modulator for modulating said exposure illumination to form a second exposure pattern according to image data;
(d) combining optics providing a single output path for directing said first and second exposure patterns onto the photosensitive medium;
(e) transport means for providing, during exposure, lengthwise displacement of the photosensitive medium with respect to said single output path;

wherein said first and second spatial light modulators cyclically alternate in providing respective said first and second exposure patterns to said combining optics, such that during a cycle wherein said first spatial light modulator forms said first exposure pattern, said second spatial light modulator loads the image data for providing said second exposure pattern; and

said first and second exposure patterns thereby forming the latent watermark, wherein each of the lengthwise stripes has a predetermined intensity corresponding to said first and second exposure patterns.

19. An apparatus for exposing a latent watermark as a series of lengthwise stripes along a length of photosensitive medium, the apparatus comprising:

(a) an illumination source for providing an exposure illumination;
(b) a spatial light modulator for modulating said exposure illumination to form an exposure pattern according to image data;
(c) a lens for directing said exposure pattern toward the photosensitive medium;
(d) transport means for providing, during exposure, lengthwise displacement of the photosensitive medium with respect to said lens;
and

said exposure pattern thereby forming the latent watermark, wherein each of the lengthwise stripes has a predetermined intensity corresponding to said exposure pattern.

20. An apparatus for exposing a latent watermark according to claim 19 wherein said spatial light modulator is a DMD.

21. An apparatus for exposing a latent watermark according to claim 19 wherein said illumination source is taken from the group comprising a lamp, an LED, and a laser.

22. An apparatus for exposing a latent watermark according to claim 19 wherein said exposure illumination is monochrome.

23. An apparatus for exposing a latent watermark according to claim 22 wherein said exposure illumination is blue.

24. An apparatus for exposing a latent watermark according to claim 19 wherein said illumination source comprises an LED and a drive circuit that provides pulses exceeding the continuous current rating of said LED.

25. An apparatus for exposing a latent watermark according to claim 19 wherein said photosensitive medium is a motion picture print film.

26. A method for exposing a latent watermark along a length of photosensitive medium, the method comprising:

(a) energizing an illumination source for providing an exposure illumination;

(b) forming a first exposure pattern according to image data by modulating said exposure illumination at a first spatial light modulator;

(c) forming a second exposure pattern according to image data by modulating said exposure illumination at a second spatial light modulator;

(d) directing said first and second exposure patterns onto the photosensitive medium over a single output path;

(e) providing, during exposure, lengthwise displacement of the photosensitive medium with respect to said single output path, exposing a set of lengthwise stripes thereby; and

wherein said first and second spatial light modulators cyclically alternate in forming respective first and second exposure patterns, such that during a cycle wherein said first spatial light modulator forms said first exposure pattern, said second spatial light modulator loads the image data for forming said second exposure pattern.

27. A method for exposing a latent watermark according to claim 26 wherein the step of energizing an illumination source comprises the step of energizing an LED.

28. A method for exposing a latent watermark according to claim 26 wherein the step of energizing an illumination source comprises the step of energizing a laser.

29. A method for exposing a latent watermark according to claim 26 wherein the step of energizing an illumination source comprises the step of energizing a lamp.

30. A method for exposing a latent watermark according to claim 26 wherein the step of directing said first and second exposure patterns onto the photosensitive medium over a single output path comprises the step of directing light through a polarization combiner.

31. A method for exposing a latent watermark according to claim 26 wherein the step of directing said first and second exposure patterns onto the photosensitive medium over a single output path comprises the step of directing light through a polarization beamsplitter.

32. A method for exposing a latent watermark according to claim 26 wherein said first spatial light modulator is an LCD.

33. A method for exposing a latent watermark according to claim 26 wherein the step of forming a first exposure pattern comprises the step of forming a pattern over only a portion of the imaging surface of said first spatial light modulator.

34. A method for exposing a latent watermark according to claim 33 wherein the step of directing said first and second exposure patterns onto the photosensitive medium over a single output path comprises the step of optically centering said portion of said first spatial light modulator in said single output path.

35. A method for exposing a latent watermark according to claim 26 wherein the step of energizing an illumination source comprises the step of momentarily driving an LED with current in excess of its continuous rated current.

36. A method for exposing a latent watermark according to claim 26 wherein the step of forming said first exposure pattern at said first spatial light modulator comprises the step of modulating a rectangular set of pixels having a length dimension in the direction of said lengthwise displacement of the photosensitive medium.

37. A method for exposing a latent watermark according to claim 26 wherein said first and second exposure patterns are shifted to provide interleaving.

38. A method for exposing a latent watermark along a length of photosensitive medium, the method comprising:

- (a) energizing an illumination source for providing an exposure illumination;
- (b) forming an exposure pattern according to image data by modulating said exposure illumination at a spatial light modulator;
- (c) directing said exposure pattern onto the photosensitive medium over an output path; and
- (d) providing, during exposure, lengthwise displacement of the photosensitive medium with respect to said output path, exposing a set of lengthwise stripes thereby.

39. A method for exposing a latent watermark according to claim 38 wherein the step of modulating said exposure illumination at a spatial light modulator comprises the step of modulating a DMD.